

Artesian Encyclopedia Article

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Artesian

Artesian refers to a condition in which **groundwater** flows from a well without the aid of a pump or other artificial means. One can speak of artesian wells, artesian aquifers, or artesian **water**. Artesian conditions arise when the energy per unit weight possessed by groundwater is great enough to force the water from a deeply buried **aquifer** to the ground surface in the event that the aquifer is tapped by a well. Artesian wells were used by ancient Egyptians, and the word artesian comes from the French province of Artois, where the first European artesian well was constructed in 1126.

The energy per unit weight of groundwater is known as hydraulic head and consists of two main components, elevation head and pressure head. Elevation head is the potential energy per unit weight due to the elevation of the groundwater, whereas pressure head is the energy per unit weight arising as water flows downward and is compressed by the weight of the overlying water. Flowing groundwater also possesses kinetic energy proportional to the square of its velocity, but groundwater generally moves so slowly that its velocity head is virtually nonexistent. Hydraulic head has units of length and is measured relative to some reference elevation, typically sea level; in practical terms, it is defined as the elevation to which groundwater will rise in a specially constructed well known as a piezometer. Thus, the hydraulic head of artesian groundwater must be equal to or greater than the elevation of the ground surface to which it is flowing.

Artesian aquifers are confined, meaning that they are sandwiched between lower **permeability** aquitards. Artesian water enters confined aquifers at high elevations and flows downward towards areas of lower hydraulic head. Although elevation head decreases as groundwater flows downward within an aquifer, pressure head increases because the aquifer is confined and energy must be conserved. Artesian groundwater, therefore, has nearly the same hydraulic head deep underground as it did when it entered the confined aquifer at a higher elevation. When a well is drilled into the artesian aquifer, the hydraulic head of the groundwater will be great enough that the water will rise to nearly the elevation at which it entered the aquifer.

See Also

Hydrogeology; Hydrologic Cycle; Hydrostatic Pressure